# USING DYNAMICS MODELING TO FOSTER CHANGE IN PRIMARY CARE PRACTICES

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In this, think tank, we facilitated a dialogue about the utility of system dynamics modeling as a means to develop a simulation tool that will foster understanding about how to improve implementation of the Public Health Services (PHS) Guideline for Treating Tobacco Use and Dependence in primary care practices. System dynamics modeling has been shown to promote deeper understanding of complex human and organizational problems and has been demonstrated to be a valuable technique for developing and implementing effective policies for government and industry, alike [1-5].

The simulation tool, currently in development with support from NIDA and OBSSR (R03 DA022278-01A1; Lounsbury, PI), is built around three interrelated conceptual domains, namely: (1) delivery of primary care, (2) tobacco use among patients, and (3) changes in patients' health. The level of analyses for the simulation tool is the primary care practice setting. It will examine the dynamics of a small primary care practice (1-5 physicians per practice) in relation to simulated tobacco use and health indicators among its patient population. System dynamics has been used to study community and population impacts of varied public health problems and policies [6], including tobacco policies [7-9]. However, system dynamics modeling has not yet been used to study practice patterns and the impact of systems-level procedural changes.

## Key Challenges in Implementing the PHS Tobacco Treatment Guideline

**Magnitude of the Public Health Problem.** Tobacco use is the leading preventable cause of premature death in the United States. Each year, more than 440 000 Americans die of tobacco-related disease, accounting for 1 in every 5 deaths. Cigarette smoking is responsible for more than 30% of cancer deaths annually in the United States. Smoking also contributes substantially to deaths from heart disease, stroke, and chronic obstructive pulmonary disease.

**Barriers to Tobacco Treatment in the Primary Care Setting.** Further reductions in tobacco use calls for increased readiness and capacity of primary care physicians to treat tobacco dependence [10]. Brief counseling intervention by primary care providers has been shown to effectively promote tobacco use cessation, yet many physicians do not consistently adhere to this practice for all patients at each appointment [11-13]. Significant barriers exist that can interfere with clinicians' assessment and treatment of smokers. Many clinicians lack knowledge about how to identify smokers quickly and easily, which treatments are efficacious, how treatments can be delivered, and the relative efficacies of different treatments [14].

Even if clinical knowledge is strong, many physicians do not consistently use this intervention [11-13]. Primary care physicians are more likely to report counseling patients about smoking cessation than other medical professionals, but are not more likely to refer them for counseling [15]. Too little time, poor training, lack of third-party reimbursement, competing clinical

problems, and the belief that their patients are not able to change also explain why some physicians do not adhere to the guideline [16-18]. Efforts to encourage adaptation of well-established clinical practice guidelines must address the tension between time limitations and best practices.

**Fostering Effective, Sustainable Practice Change.** Academic detailing is an effective way to foster practice change with primary care physicians and other health care providers. A typical approach to academic detailing involves the provision of written materials and sample supplies, didactic training, auditing (with feedback), 'reminder' systems, and one or more office-based consultations [19-21]. A recent Cochrane review by O'Brien and colleagues [22] examined the effectiveness of educational outreach visits, or academic detailing, to promote changes in medical and health care provider practices. In 13 of 18 randomized trials examined, the targeted provider behavior was prescribing practices. Three studies addressed preventive practices, including brief counseling for smoking cessation [23, 24]. Collectively, these efforts help detailers establish a rapport with providers that, in turn, can generate effective change in practices.

Although positive outcomes were observed in all studies in the review, interventions that provided one or more of the following, including individual instruction, used audit and feedback strategies, incorporated review by peers, and that successfully integrated 'reminder' systems, were among the most effective for medical professionals [25, 26] [27-31]. Results did not reveal a clear relationship between the number of office visits by detailers and impact on the provider, although it was noted that interventions with as few as one or two visits had positive effects. Overall, academic detailing appears to be a promising way to change provider behaviors, especially when the behavior was prescribing medications. However, additional research on interventions intended to change preventive practices, including tobacco treatment practices [20], is needed. Although dissemination-only strategies (e.g., conferences and mailings) always demonstrated smaller effects than interventions involving outreach visits or peer review, such interventions had varying levels of effective impact [32].

**Strategic Approach: Enhanced Academic Detailing via System Dynamics Modeling**

The Think Tank addressed our assertion that system dynamics modeling tools have the potential to transform how clinical guidelines and scientific reviews are disseminated to busy professionals. A well-designed simulation tool could greatly accelerate the rapport-building process between detailers and providers. We hypothesize that the capability to automatically simulate the dynamics of implementing practice changes during the course of either a didactic training session and/or an office-based consultation would help an academic detailer quickly learn about a provider's practice environment and help providers make practice-specific, cost-effective decisions about how to most efficiently and rapidly attain (and/or sustain) evidence-based standards of tobacco treatment for their patients. A tool with this capability would allow for quick comparison of alternative ways of changing office procedures by generating scenarios that simulate different combinations of role-sharing or resource exchange.

**Current Study Procedures and Formative Assessment of the System Dynamics Tool.** The simulation tool we presented at the Think Tank was organized around three interrelated conceptual domains, namely: (1) delivery of primary care, (2) tobacco use among patients, and (3) changes in patients' health. The level of analyses for the simulation tool is the primary care practice setting. It will examine the dynamics of a small primary care practice (1-5 physicians

per practice) in relation to simulated tobacco use and health indicators among its patient population.

We discussed who the study is being conducted in two stages. In the first stage, we will work collaboratively with an expert advisory group to construct a working system dynamics model of the simulation tool. In the second stage, the final 'beta' version of the simulation tool will then be subjected to a formative assessment in an academic detailing intervention with 30 small, community-based primary care practices. Our formative assessment will examine: (1) feasibility and acceptability of using the simulation tool in an academic detailing intervention, (2) changes in individual provider attitudes about and practices in tobacco treatment, (3) and implementation of new or improved office systems to improve tobacco treatment at the practice level.

Feedback obtained from these field tests will then be used to refine the tool itself, as well as how it can be most effectively presented and used by primary care practices to foster implementation of the PHS guidelines.

**Think Tank Discussion Points**

Discussion among Think Tank participants involved questions and comments about the process of 'quitting smoking' and how they could be addressed, both theoretically and practically, using system dynamics models as tools for both research and teaching. Participants indicated that they could appreciate how system dynamics models and the simulation output generated could allow one to 'see complexity' with greater ease. However, the degree to which this could be achieved, it was noted, had to be a function of the target audience's understanding of the problem being modeled as well as the 'layout' and naming or labeling of the variables included in the model.

The issue of obtaining valid, reliable data to inform the initial parameters of the model was also raised. Some primary care practices will be better equipped than others to provide data about tobacco screening and treatment for their patients than others. Where data is sparse or not of high quality, the level of 'buy-in' or acceptability of the simulated output for a specific primary care practice maybe low. And, further, if 'buy-in' is low, then the extent to which physicians would take action to change their own behaviors with patients who use tobacco or to try out new treatment policies or strategies in their offices would be reduced.

Nonetheless, think tank participants were intrigued by the notion that system dynamics modeling is a way to efficiently conduct 'virtual experiments' on any given topic of interest. Participants noted that an important part of designing these experiments involved critical thinking about questions such as: How often does a patient actually visit their primary care provider each year? When then visit, how much time is allocated to the visit, and to tobacco treatment? And, what influences the amount of time allocated to tobacco treatment for a patient during a given visit, or over the course of a year, or two? Do providers give more or less time to tobacco treatment to patients who have relapsed? Or who have quit and are staying quit? What are the most salient provider barriers to effective use of pharmacotherapies? How does treating tobacco use affect practice revenues and expenses? When does a patient being to realize, or perceive, the health benefits of tobacco cessation? Are patients who are treated for tobacco use successfully a source of new patient referrals, from the community?

Overall, participants appreciated the potential for applying system dynamics to their dissemination and implementation research. However, they also noted that, for most behavioral and social scientists, system dynamics modeling was a new and starkly different way of

conducting research. In particular, the presenter and discussant noted that much time is devoted to building the model around the perspective, or understanding, of the model's intended target, in this case the primary care providers. How to do this effectively was an area of concern for many think tank participants.

Participants also underscored the potential challenge of learning to build system dynamics models. The presenter acknowledged that there is a steep learning curve, although less so for students who had more training in mathematics, particularly those who had taken coursework in calculus. Also, from a technical point of view, many new to system dynamics have difficulty distinguishing between 'stocks' and 'flows,' as these are terms not often used to define and study change processes in individuals or organizations. To learn develop system dynamics models, the presenter referred think tank participants to a number of resources, including John Sterman's textbook (2000). For further information on where to turn for formal training in system dynamics, participants were referred to the System Dynamics Society internet home page.

## Future Research

Think tank participants noted that system dynamics modeling is a methodology suitable for research on virtually any study that examines processes of change at one more levels (i.e., individual level, family, organization or practice, community, etc.). For behavioral and social scientists, system dynamics offers a research approach for explicitly examining and interpreting *change* in the context of complex problems, such as integrating tobacco treatment into community-based primary care settings. Future research stemming from the current study could apply system dynamics to a wide range of health behavior interventions including, for example, prevention and treatment of diabetes, obesity, and substance abuse.

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